Application

for

United States Patent

To all whom it may concern:

      Be it known that we, Michael Dunk and Mary Crist, have invented certain new and useful improvements in

Equation Editor

of which the following is a clear description:

EQUATION EDITOR

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001]   The present application claims priority to U.S. Provisional Application No. 60/445,823, filed on February 10, 2003, entitled "EQUATION EDITOR."

[0002]   U.S. Patent No. 6,302,698, filed on February 16, 1999, and U.S. Application Serial No. 2001/0034016, filed on January 12, 2001, are hereby incorporated by reference in their entireties.

FIELD OF THE INVENTION

[0003]   The present invention generally relates to the field of electronic editing and review. The present invention particularly relates to methods and systems for creating, editing, transmitting and receiving equations in an electronic format. In a preferred embodiment, one or more computer systems are used to construct, edit and/or transmit equations to a remote terminal where the submitted equations, for example, may be reviewed for correctness.

BACKGROUND OF THE INVENTION

[0004]   Instructors and testing professionals generally regard mathematical problem solving experience as an effective method of developing math skills. In this regard, literature pertaining to the teaching of math suggests that solving a greater number of problems may facilitate improvement in a student's math ability.

[0005]   As the use of computers in classrooms and in home learning environments has increased, students have increasingly desired to solve math problems using computer systems. A

number of conventional computer-based equation and expression editors have become available

for students to use, including MathML, WebMathematica, Quickmath, NetTutor™, and LaTeX.

[0006] MathML is intended to facilitate the use and re-use of mathematical and

scientific content on the Internet and for other applications such as computer algebra systems,

print typesetting and voice synthesis. MathML can be used to encode both the presentation of

mathematical notation for high-quality visual displays and mathematical content for applications

where semantics are generally important, such as in scientific or voice synthesis software.

[0007] WebMathematica is based on Mathematica Server Page ("MSP") technology.

MSP technology allows a website to include HTML pages that are enhanced by the addition of

Mathematica commands. When a user requests such a page, which are generally called MSP

scripts or more simply MSPs, Mathematica commands within the page description are evaluated,

and the result is placed on the page.

[0008] QuickMath is an automated service for answering common math problems over

the Internet.

[0009] LaTeX is a document preparation system that permits high-quality typesetting.

LaTeX is typically used for medium to large technical or scientific documents; however, it may

be used for almost any form of publishing.

[0010] All of the above-described math tools permit the user to draft equations using a

computer-based system. However, none of the tools permits equations to be drafted in a real

time teaching environment in which students interact with a teacher.

[0011] NetTutor™ is a distance-learning environment for the dissemination of online

content. NetTutor™ is an Internet-based graphical chat window that is threaded and platform

independent. It allows students to use their computers to access learning materials in a non-

linear fashion or in real time with live corresponding tutors. Only one student may interact with a tutor at a time although a plurality of students may view the interaction.

[0012] However, NetTutor™ does not permit a teacher to interact with a plurality of students concurrently by posing a question and receiving mathematical expressions as responses from each student. Moreover, mathematical expressions entered into NetTutor™ are not evaluated for correctness by the system based on a previously constructed answer set.

[0013] What is needed is a system and method for permitting a plurality of students to interact with a teacher using a computer-based equation editor.

[0014] A need exists for a system and method for permitting a plurality of remote computer systems to receive, edit and submit equations to a central computer terminal for scoring and/or review.

[0015] A further need exists for real time systems and methods for performing one or more of the listed functions.

[0016] A still further need exists for a system that can automatically compare received responses to a previously constructed answer set for real time determination of whether the responses are correct.

[0017] The present invention is directed towards solving one or more of these problems.

SUMMARY OF PREFERRED EMBODIMENTS

[0018] Before the present methods, systems, and materials are described, it is to be understood that this invention is not limited to the particular methodologies, systems and materials described, as these may vary. It is also to be understood that the terminology used in the description is for the purpose of describing the particular versions or embodiments only, and

is not intended to limit the scope of the present invention which will be limited only by the appended claims.

[0019]   It must also be noted that as used herein and in the appended claims, the singular forms "a," "an," and "the" include plural references unless the context clearly dictates otherwise. Thus, for example, reference to an "equation" is a reference to one or more equations and equivalents thereof known to those skilled in the art, and so forth. Unless defined otherwise, all technical and scientific terms used herein have the same meanings as commonly understood by one of ordinary skill in the art. Although any methods, materials, and devices similar or equivalent to those described herein can be used in the practice or testing of embodiments of the present invention, the preferred methods, materials, and devices are now described. All publications mentioned herein are incorporated by reference. Nothing herein is to be construed as an admission that the invention is not entitled to antedate such disclosure by virtue of prior invention.

[0020]   In a preferred embodiment, a system for editing, comparing, and resolving equations includes a communications network, at least one teacher computer, and a plurality of student computers. Each student computer and each teacher computer are operably connected via the communications network. Each teacher computer includes an input device, a display, and a computer-readable storage medium containing program instructions for implementing a teacher equation editor application. Each student computer includes an input device, a display, and a computer-readable storage medium containing program instructions for implementing a student equation editor application.

[0021]   The teacher equation editor application may include one or more program instructions for implementing a communications protocol that controls communication between

the teacher computer and the plurality of student computers via the communications network.

The teacher equation editor application may include one or more program instructions for

receiving a question description via the input device, storing the question description, receiving

one or more answers corresponding to the question description via the input device, and storing

the one or more answers. Each answer may include one or more of an equation and an

expression. The input device for the teacher computer may include a pointing device and/or a

keyboard. In an embodiment, the question description is stored in the computer-readable storage

medium of the teacher computer. In an embodiment, one or more answers are stored in the

computer-readable storage medium of the teacher computer. The teacher equation editor

application further includes one or more program instructions for transmitting the question

description to each student computer via the communications network. The teacher equation

editor application further includes one or more program instructions for receiving a response

from one of the plurality of student computers via the communications network, and comparing

the response with the one or more answers corresponding to the question description. At least

one response may be received in a rendered format and/or a character syntax. In an embodiment,

comparing the response includes rendering the response from the character syntax into a

rendered expression. The teacher equation editor application further includes one or more

program instructions for displaying the rendered expression on the display of the teacher

computer. The teacher equation editor application further includes one or more program

instructions for storing an indication that the response is correct, if the response is equal to at

least one answer, and storing an indication that the response is incorrect, if the response is not

equal to at least one answer. The teacher equation editor application further includes one or

more program instructions for generating a learning reinforcement signal. The teacher equation

editor application further includes one or more program instructions for transmitting a learning

reinforcement signal to the student computer. The reinforcement signal is transmitted at

substantially the same time as the comparison of the response with the one or more answers

completes. The teacher equation editor application may include a web browser application.

[0022] The student equation editor application includes one or more program

instructions for receiving a question description via the communications network, displaying the

question description on the display corresponding to the student computer, and receiving one or

more responses to the question description via the input device. Each response includes one or

more of an equation and an expression. The input device for the student computer includes a

pointing device and/or a keyboard. At least one response is received in a character syntax and/or

a rendered format. The student equation editor application further includes one or more program

instructions for transmitting at least one response to the teacher computer via the

communications network. In an embodiment, transmitting at least one response occurs at

substantially the same time as the at least one response is received via the input device. The at

least one response is transmitted in a character syntax. The student equation editor application

further includes one or more program instructions for generating at least one learning

reinforcement signal, and displaying the at least one learning reinforcement signal on the display

corresponding to the student computer display. Generating at least one reinforcement signal

occurs at substantially the same time as at least one response to the question description is

received. The student equation editor application further includes one or more program

instructions for receiving at least one learning reinforcement signal from the teacher computer

via the communications network, and displaying the at least one learning reinforcement signal on

the display corresponding to the student computer. The student equation editor application includes a web browser application.

[0023] In an embodiment, the system for editing, comparing and resolving equations further includes a comparison device. Each student computer, each teacher computer and the comparison device are operably interconnected via the communications network. The comparison device includes a computer-readable storage medium. The comparison device includes a comparison application comprising one or more program instructions for receiving a response from one of the plurality of student computers via the communications network, and comparing the response with the one or more answers corresponding to the question description. At least one response may be received in a rendered format and/or in a character syntax. In an embodiment, comparing the response includes rendering the response from the character syntax into a rendered expression. In an embodiment, the teacher equation editor application further includes one or more programming instructions for receiving the response, rendering the response into a rendered expression, and displaying the rendered expression on the display of the teacher computer. The comparison application further includes one or more program instructions for storing an indication that the response is correct, if the response is equal to at least one answer, and storing an indication that the response is incorrect, if the response is not equal to at least one answer. The comparison application further includes one or more program instructions for transmitting a learning reinforcement signal to the student computer. The reinforcement signal is transmitted at substantially the same time as the comparison of the response with the one or more answers completes. The student equation editor application further includes one or more program instructions for transmitting at least one response to the comparison device via the communications network. In an embodiment, transmitting at least one

response occurs at substantially the same time as the at least one response is received via the input device. The at least one response is transmitted in a character syntax. The student equation editor application further includes one or more program instructions for receiving at least one learning reinforcement signal from the comparison device via the communications network.

[0024]   In an embodiment, a method of editing, comparing and resolving equations includes receiving a question description on a teacher computer system, receiving one or more answers on a teacher computer system, and transmitting the question description to a plurality of student computer systems. Each answer includes one or more of an equation and an expression. The method may further include receiving a plurality of responses, and determining, for each response, if the response matches at least one answer. At least one response is received from each of the plurality of student computer systems. The method may further include transmitting at least one learning reinforcement to the second computer system associated with the response. The type of learning reinforcement may be determined by whether the response matches at least one answer.

[0025]   In an embodiment, a method of editing, comparing, and resolving equations includes receiving a question description on a student computer system from a teacher computer system, displaying the question description, receiving at least one response to the question description, and transmitting the at least one response to the teacher computer system. Each response includes one or more of an equation and an expression. The method may further include receiving at least one learning reinforcement from the teacher computer system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]   The accompanying drawings, which are incorporated in and form a part of the specification, illustrate preferred embodiments of the present invention and, together with the description serve to explain the principles of the invention. The embodiments illustrated in the drawings should not be read to constitute limiting requirements, but instead are intended to assist the reader in understanding the invention.

[0027]   FIG. 1 depicts a screen capture of an exemplary teacher equation editor dialog window according to an embodiment of the present invention.

[0028]   FIG. 2 depicts a screen capture of exemplary student responses on a teacher computer according to an embodiment of the present invention.

[0029]   FIG. 3 depicts a screen capture of an exemplary teacher view of rendered student responses according to an embodiment of the present invention.

[0030]   FIG. 4 depicts a screen capture of an exemplary student browser view of a rendered equation and an equation editor according to an embodiment of the present invention.

[0031]   FIG. 5 depicts a screen capture of a second exemplary student browser view of a rendered equation and an equation editor according to an embodiment of the present invention.

[0032]   FIG. 6 depicts an exemplary embodiment of the present invention in which the comparison device is co-located with the teacher computer.

[0033]   FIG. 7 depicts an exemplary embodiment of the present invention in which the comparison device is connected to the communications network.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0034] In the following description, various embodiments of an equation editor system, along with methods of construction and use are provided. The examples contained herein refer specifically to mathematical equations. In general, the terms "mathematical equation" or simply "equation" refer to technical expressions typically associated with mathematical and/or scientific symbols. However, it is to be understood that the invention is not limited to the manipulation of mathematical equations or expressions. Alternate embodiments of the present invention may be used to represent, for example, sentence structure or chemical compounds. Additional embodiments of the invention may be utilized to manipulate a variety of symbols, expressions and the like.

[0035] In an embodiment, the present invention relates to on-line teaching and monitoring of student learning on a plurality of computer devices connected via a communications network, such as an intranet and/or the Internet. Each computer may include an input device, a display and/or a computer-readable storage medium for storing program instructions. Each computer device may use, for example, a web browser as an interface with the communications network. Preferably, the on-line teaching and learning system provides change-by-change and/or real time reinforcement signals for students. Simultaneously, the on-line teaching and learning system provides monitoring by the teacher of the current student responses and an indication of the correctness of the answer. The system may operate using a packet switched communications network, a cell switched communications network, a direct connection or any other communications protocol or connection type. The system may include one or more teacher computers. The student computers may be co-located with the teacher computer and/or may connect to the teacher computer from a remote location.

[0036]   A convenient interface for entering expressions and equations may be provided. The interface may facilitate the submission of expressions and equations that would be difficult to enter using a standard keyboard. A teacher may use an interface, such as the one shown in FIG. 1 at **100**, to pose one or more questions to students. Students may use a similar interface, such as **405** in FIG. 4, to respond to questions. The teacher computer, the student computer or a comparison device may evaluate the student responses on a change-by-change basis and/or in real time for correctness. In an embodiment, the teacher computer may further provide real time reinforcement signals to student computers. In an embodiment, each of the teacher computer and the student computers may generate real time reinforcement signals. In an embodiment, student responses may be evaluated on a separate comparison device. The comparison device may generate and transmit real time reinforcement signals to one or more of the teacher computer and the student computer that transmitted the student response corresponding to the reinforcement signal. Simultaneous monitoring, including updating each change in each student response, may be provided by the teacher computer, the student computer and/or the comparison device.

[0037]   As shown in FIG. 2, a teacher computer may display an interface **200**, which includes a question frame **205**, an answer frame **210**, and a current student response frame **215**. The question frame **205** may contain a question **207** that is transmitted to each of the student computers. The answer frame **210** may contain one or more answers **212a-b** to the corresponding question **207**. The current student response frame **215** may include information pertaining to one or more student responses **217a-c**. In a preferred embodiment, for each student, the information pertaining to the one or more student responses **217a-c** may include, for example, the student's name **220**, an answer correct field **222**, the number of times the student has attempted to answer the question **224**, and the current student response **226**. The current

student response **226** may be updated on a change-by-change basis and/or in real time based on input from the corresponding student using a student computer. The teacher interface **200** may evaluate whether the current student response **226** for a particular student is correct. If a current student response **226** matches one or more of the answers **212a-b**, the teacher interface **200** may provide an indication in the corresponding answer correct field **222** and send a reinforcement signal to the student computer.

[0038] A character-based syntax that describes the entered equation or expression may be provided. The syntax may be designed to be easily understood and entered by a student or teacher. In addition, the representation of the equation may allow easy verification of correctness by a teacher using a teacher computer. A display showing the rendered equation or expression may be provided, as shown in FIG. 3. The teacher computer may render the equation or expression in real time as the equation or expression is entered. Equations or expressions may be entered by, for example, selecting one or more symbols from a menu, selecting one or more symbols using buttons in the application, using one or more hotkeys, and/or entering information in the character-based syntax. In an embodiment, all symbols, variables, and operations may be presented to the user simultaneously as a palette of buttons. In the case of question development, the rendered equation or expression may be displayed in the rendered expression display window **145** of the teacher equation editor interface **100**. In the case of student responses, rendered equations or expressions **317a-c** based on equations or expressions from one or more student computers may be displayed on the teacher computer in the teacher interface **200**.

[0039] Preferably, teachers and students may use the equation editor to enter math notation, as required for questions, answers and student responses. In an Edit Math Notation dialog window, such as **100**, text representation of math notation may be entered in a text box,

such as **105**. Other Edit Math Notation dialog windows are shown at **410** and **505**. The text

representation may be displayed substantially in real time on a graphical display. Text and/or

select symbols and expressions may be selected from, for example, one or more toolbars, one or

more menus, hot keys, or a set of buttons. Selected entries may be highlighted in the text box

105 by, for example, displaying the entries in a different color, changing the background color

for the entries, or altering the size of the entries.

[0040]   As shown in FIGs. 4 and 5, students are preferably provided with a question **406**

within a frame **404** in an application on the student computer. The question **406** may require the

students to respond in the form of a response **415**. A response **415** may be in the form of an

equation or expression. Equations or expressions may be entered by, for example, selecting one

or more symbols from a menu, selecting one or more symbols using buttons in the application,

using one or more hotkeys, and/or entering information in the character-based syntax. In an

embodiment, all symbols, variables, and operations may be presented to the user simultaneously

as a palette of buttons. The student computer may transmit the response to the teacher computer

or a separate comparison device where the response is automatically scored. The teacher may

optionally subjectively evaluate a written explanation (not shown).

[0041]   FIG. 6 depicts an exemplary embodiment of the present invention in which the

comparison device is co-located with a teacher computer. In an embodiment, the teacher

computer **605** may compare responses to a question description received from the student

computers **620a-c** to one or more answers corresponding to the question description using a

comparison device **610** that is resident in the teacher computer **605**. A response may be

transmitted from a student computer, such as **620a**, to the teacher computer **605** via a

communications network **615**. Once the teacher computer **605** receives a response, the

comparison device **610** may compare the response with one or more answers and transmit a

reinforcement signal to the student computer **620a** via the communications network **615**. The

nature of the reinforcement signal may be based on whether the comparison device **610**

favorably compares the received response to the one or more answers.

[0042]   FIG. 7 depicts an exemplary embodiment of the present invention in which the

comparison device is connected to the communications network. In an alternate embodiment,

the comparison device **610** may be connected to the teacher computer **605** via the

communications network **615**. One or more answers to a question description may be contained

on a comparison device **610**. In an embodiment, the teacher computer **605** may transmit the one

or more answers to the comparison device **610**. The teacher computer **605** may then transmit the

question description to the student computers **620a-c** via the communications network **615**. A

response generated by a student computer, such as **620a**, may be transmitted to the comparison

device **610** via the communications network **615**. The comparison device **610** may transmit a

reinforcement signal to the teacher computer **605** and/or the student computer from which the

response was received **620a** via the communications network **615**. The nature of the

reinforcement signal may be based upon whether the comparison device **610** favorably compares

the response to the one or more answers.

[0043]   In an embodiment, a comparison device **610** may be resident on each student

computer **620a-c**. In this embodiment, a teacher computer **605** may transmit a question

description and one or more answers to each student computer **620a-c** via the communications

network **615**. The student computers may display the question description. The one or more

answers may be sent to the comparison device **610** and may not be displayed. As a user

responds to the question description, the comparison device **610** may compare the response to

the one or more answers and may generate a reinforcement signal. The nature of the

reinforcement signal may be based upon whether the comparison device **610** favorably compares

the response to the one or more answers.

[0044]   In an embodiment, an interface may implement at least one of the following

commands and functions. Examples showing the use of the commands and functions according

to the preferred embodiment are presented for clarity where appropriate. Any standard computer

interface, such as toolbars, menus, buttons, hot keys and the like may be used to implement the

present invention. The scope of the present invention is not intended to be limited to the

embodiment presented below, which is presented only to further describe one of many possible

embodiments of the present invention.

Keyboard Entries

[0045]   RETURN – Press the ENTER key to insert "\RETURN" at the current insertion

point in the text box. In response to pressing ENTER, the next notation may be displayed below

the previously entered notation.

[0046]   TAB – Press the TAB key to move to and select the next insertion marker or to

move to the end of the text entry in the text box.

Insertion Markers

[0047]   As shown in FIG. 1, toolbar buttons for parentheses **110**, fraction **115**, square

root **120**, superscript **125**, and subscript **130** may be presented in an equation editor dialog

window **100**. The buttons **110 – 130** may insert characters and special insertion markers

associated with the respective button. The cursor may blink in the text box **105** and a vertical

gray bar (not shown) may be displayed when one of these buttons **110 – 130** is selected. An

insertion marker acts as a placeholder for the content of the expression. For example, to enter

"(x+y)," the parentheses button **110** may be selected. The insertion marker may appear between

the open and close parentheses. The user may then type "x+y" at the insertion point.

Button/Menu Entries

[0048]   PARENTHESES – Parentheses may be entered directly into the text box **105**.

Alternatively, a parentheses button **110** or a parentheses menu item or hot key sequence may be

selected to insert parentheses enclosing an insertion marker. If text is selected prior to clicking

the parentheses button **110**, selecting the parentheses menu item or entering the parenthesis hot

key sequence, the selected text may be surrounded by parentheses.

[0049]   FRACTION – A forward slash ("/") may be entered directly into the text box

105 to represent a fraction (e.g., type "x/y"), or the fraction button **115** or a fraction menu item or

hot key sequence may be selected to insert a forward slash and parentheses enclosing insertion

markers for each of the numerator and the denominator. For example, to insert "(x+y)/(1+x)," a

user may click the fraction button **115**, select the fraction menu item or enter the fraction hot key

sequence, type "x+y," press TAB, and type "1+x." If text is selected prior to clicking the

fraction button **115**, selecting the fraction menu item or entering the fraction hot key sequence,

the selected text becomes the numerator of the fraction and is automatically enclosed in

parentheses.

[0050]   SQUARE ROOT – The square root button **120** or the square root menu item

may be selected, or the square root hot key sequence may be entered, to insert "\SQRT" followed

by parentheses enclosing an insertion marker. For example, to insert the notation for the square

root of 4, a user may click the square root button **120**, select the square root menu item or enter

the square root hot key sequence and type "4." If text is selected prior to clicking the square root

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button **120**, selecting the square root menu item or enter the square root hot key sequence, the selected text is surrounded by parentheses and becomes the content of the square root expression.

[0051]   SUPERSCRIPT – The notation for a superscript includes two expressions: the subject expression to which the superscript is attached and the superscript expression, which is displayed in a smaller font higher than the subject expression. The superscript button **125**, the superscript menu item or superscript hot key sequence may be selected to enter "\SUPER" followed by parentheses enclosing an insertion marker for the superscript expression. For example, to insert the notation for x-squared, a user may type "x," click the superscript button **125**, select the superscript menu item or enter the superscript hot key sequence, and type "2." If text is selected prior to selecting the superscript button **125** or the superscript menu item, or entering the superscript hot key sequence, the selected text becomes the superscript and is automatically enclosed in parentheses.

[0052]   SUBSCRIPT – The notation for subscript includes two expressions: the subject expression to which the subscript is attached and the subscript expression, which is displayed in a smaller font lower than the subject expression. The subscript button **130**, the subscript menu item or the subscript hot key sequence may be selected to enter "\SUB" followed by parentheses enclosing an insertion marker for the subscript expression. For example, to insert the notation for x-squared, a user may type "x," click the subscript button **130**, select the subscript menu item or enter the subscript hot key sequence, and type "2." If text is selected prior to selecting the subscript button **130**, selecting the subscript menu item or entering the subscript hot key sequence, the selected text becomes the subscript and is automatically enclosed in parentheses.

[0053]   MATH SYMBOL – Four categories of symbols may be provided: Relational symbols **420**, Operator symbols **425**, Greek characters **430**, and Miscellaneous/Other symbols

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435. To access the symbols, a user may click the math symbol button **135**, select the math

symbol menu item or enter the math symbol hot key sequence. A menu may be displayed in

which each of the four categories is represented. Upon selection of a category, a sub-menu may

then be displayed in which the symbols corresponding to the selected category are displayed.

The user may select a desired symbol. The symbol may then be entered at the current insertion

point in the text box. FIG. 4 depicts a sub-menu **440** listing exemplary Relational symbols **420**

according to an embodiment of the present invention. FIG. 5 depicts a sub-menu **510** listing

exemplary Operator symbols **425** according to an embodiment of the present invention.

Nesting Expressions

[0054] Expression may be nested to many levels of complexity. For example, to insert

a fraction inside a square root symbol, a user may click the square root button **120**, click the

fraction button **115**, type the numerator, press TAB and type the denominator. Alternatively, the

user may click the fraction button **115**, type the numerator, press TAB, type the denominator,

select the fraction and click the square root button **120**. Alternatively, a user may select a menu

item or enter a hot key sequence instead of selecting a button.

Editing Math Notation

[0055] Each entry from a toolbar button **110 – 130** may be treated as a single unit when

the text representation is edited.

[0056] To edit a question that uses math notation, a user may select the math notation

and click the MATH NOTATION button (not shown). The Edit Math Notation dialog box **100**,

such as the one depicted in FIG. 1, may then be displayed. The user may edit the math notation

using the Edit Math Notation dialog box **100**. Upon completion, the user may click an OK

button **140**.

[0057]   In order to edit a math notation answer, a user may double-click inside the

answer. The Edit Math Notation dialog box **100** may then be displayed. The user may edit the

math notation using the Edit Math Notation dialog box **100** and click the OK button **140** upon

completion.

[0058]   Alternate Edit Math Notation dialog boxes may be implemented for a teacher

computer and a student computer. The Edit Math Notation dialog box **100** depicted in FIG. 1

may be used on a teacher computer and include a rendered expression display window **145**

which may show how the entered text string will be displayed upon acceptance of the text string.

The expression display window **145** may be used to verify the correctness of the text string

entered in the teacher-accessible portion of the Edit Math Notation dialog box **100**. As shown in

FIG. 4, an exemplary Edit Math Notation dialog box **410** for a student computer may be

incorporated into an Equation Editor application **402** implemented within a web browser **400**.

As shown in FIG. 5, an Edit Math Notation dialog box **505** for a student computer may

alternately be incorporated into a separate Equation Editor application **500**.

[0059]   Although the invention has been described with reference to the preferred

embodiments, it will be apparent to one skilled in the art that variations and modifications are

contemplated within the spirit and scope of the invention. The drawings and description of the

preferred embodiments are made by way of example rather than to limit the scope of the

invention, and it is intended to cover within the spirit and scope of the invention all such changes

and modifications.